CALIFORNIA HIGH-SPEED TRAIN

Program Environmental Impact Report/Environmental Impact Statement

Sacramento to Bakersfield

HYDROLOGY & WATER QUALITY TECHNICAL EVALUATION

January 2004

Prepared for:

California High-Speed Rail Authority

U.S. Department of Transportation
Federal Railroad Administration

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Federal Railroad Administration

Sacramento to Bakersfield Hydrology & Water Quality Technical Evaluation

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ACRONYMS

AUTHORITY	CALIFORNIA HIGH-SPEED RAIL AUTHORITY
BNSF	BURLINGTON NORTHERN AND SANTA FE RAILWAY
CDFG	CALIFORNIA DEPARTMENT OF FISH AND GAME
CEQA	CALIFORNIA ENVIRONMENTAL QUALITY ACT
COG	COUNCIL OF GOVERNMENTS
CWA	CLEAN WATER ACT
DLG	DIGITAL LINE GRAPH
DOT	U.S. DEPARTMENT OF TRANSPORTATION
EIR	ENVIRONMENTAL IMPACT REPORT
EIS	ENVIRONMENTAL IMPACT STATEMENT
EPA	ENVIRONMENTAL PROTECTION AGENCY
FAA	FEDERAL AVIATION ADMINISTRATION
FEMA	FEDERAL EMERGENCY MANAGEMENT ACT
FHWA	FEDERAL HIGHWAY ADMINISTRATION
FIRM	FEDERAL INSURANCE RATE MAP
FRA	FEDERAL RAILROAD ADMINISTRATION
FTA	FEDERAL TRANSIT ADMINISTRATION
HST	HIGH-SPEED TRAIN
MTA	METROPOLITAN TRANSPORTATION AUTHORITY
NEPA	NATIONAL ENVIRONMENTAL POLICY ACT
NPDES	NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
RTP	REGIONAL TRANSPORTATION PLAN
RWQCB	REGIONAL WATER QUALITY CONTROL BOARD
SFHA	SPECIAL FLOOD HAZARD AREA
SWRCB	STATE WATER RESOURCES CONTROL BOARD
UP, UPRR	UNION PACIFIC RAILROAD
USACE	U.S. ARMY CORPS OF ENGINEERS
USGS	UNITED STATES GEOLOGICAL SURVEY

1.0 INTRODUCTION

The California High-Speed Rail Authority (Authority) was created by the Legislature in 1996 to develop a plan for the construction, operation, and financing of a statewide, intercity high-speed passenger train system.[1] After completing a number of initial studies over the past six years to assess the feasibility of a high-speed train system in California and to evaluate the potential ridership for a variety of alternative corridors and station areas, the Authority recommended the evaluation of a proposed high-speed train system as the logical next step in the development of California's transportation infrastructure. The Authority does not have responsibility for other intercity transportation systems or facilities, such as expanded highways, or improvements to airports or passenger rail or transit used for intercity trips.

The Authority adopted a *Final Business Plan* in June 2000, which reviewed the economic feasibility of a 1,127-kilometer-long (700-mile-long) high-speed train system. This system would be capable of speeds in excess of 321.8 kilometers per hour (200 miles per hour [mph]) on a dedicated, fully grade-separated track with state-of-the-art safety, signaling, and automated train control systems. The system described would connect and serve the major metropolitan areas of California, extending from Sacramento and the San Francisco Bay Area, through the Central Valley, to Los Angeles and San Diego. The high-speed train system is projected to carry a minimum of 42 million passengers annually (32 million intercity trips and 10 million commuter trips) by the year 2020.

Following the adoption of the Business Plan, the appropriate next step for the Authority to take in the pursuit of a high-speed train system is to satisfy the environmental review process required by federal and state laws which will in turn enable public agencies to select and approve a high speed rail system, define mitigation strategies, obtain necessary approvals, and obtain financial assistance necessary to implement a high speed rail system. For example, the Federal Railroad Administration (FRA) may be requested by the Authority to issue a *Rule of Particular Applicability*, which establishes safety standards for the high-speed train system for speeds over 200 mph, and for the potential shared use of rail corridors.

The Authority is both the project sponsor and the lead agency for purposes of the California Environmental Quality Act (CEQA) requirements. The Authority has determined that a Program Environmental Impact Report (EIR) is the appropriate CEQA document for the project at this conceptual stage of planning and decision-making, which would include selecting a preferred corridor and station locations for future right-of-way preservation and identifying potential phasing options. No permits are being sought for this phase of environmental review. Later stages of project development would include project-specific detailed environmental documents to assess the impacts of the alternative alignments and stations in those segments of the system that are ready for implementation.

The decisions of federal agencies, particularly the Federal Railroad Administration (FRA) related to high-speed train systems, would constitute major federal actions regarding environmental review under the National Environmental Policy Act (NEPA). NEPA requires federal agencies to prepare an Environmental Impact Statement (EIS) if the proposed action has the potential to cause significant environmental impacts. The proposed action in California warrants the preparation of a Tier 1 Program-level EIS under NEPA, due to the nature and scope of the comprehensive high-speed train system proposed by the Authority, the need to narrow the range of alternatives, and the need to protect/preserve right-of-way in the future. FRA is the federal lead agency for the preparation of the Program EIS, and the Federal Highway Administration (FHWA), the U.S. Environmental Protection Agency (EPA), the U.S. Corps of Engineers (USACE), the Federal Aviation Administration (FAA), the U.S. Fish and Wildlife Service (USFWS), and the Federal Transit Administration (FTA) are cooperating federal agencies for the EIS.

[1] Chapter 796 of the Statutes of 1996; SB 1420, Kopp and Costa

A combined Program EIR/EIS is to be prepared under the supervision and direction of the FRA and the Authority in conjunction with the federal cooperating agencies. It is intended that other federal, state, regional, and local agencies will use the Program EIR/EIS in reviewing the proposed program and developing feasible and practicable programmatic mitigation strategies and analysis expectations for the Tier 2 detailed environmental review process which would be expected to follow any approval of a high speed train system.

The statewide high-speed train system has been divided into five regions for study: Bay Area-Merced, Sacramento-Bakersfield, Bakersfield-Los Angeles, Los Angeles-San Diego via the Inland Empire, and Los Angeles-Orange County-San Diego. This Hydrology and Water Quality Technical Evaluation for the Sacramento to Bakersfield region is one of five such reports being prepared for each of the regions on the topic, and it is one of fifteen technical reports for this region. This report will be summarized in the Program EIR/EIS and it will be part of the administrative record supporting the environmental review of alternatives.

1.1 ALTERNATIVES (NO-PROJECT, MODAL, HST)

1.1.1 No-Project Alternative

The No-Project Alternative serves as the baseline for the comparison of Modal and High-Speed Train alternatives (Figure 1). The No-Project Alternative represents the state's transportation system (highway, air, and conventional rail) as it existed in 1999-2000 and as it would be after implementation of programs or projects currently programmed for implementation and projects that are expected to be funded by 2020. The No-Project Alternative addresses the geographic area serving the same intercity travel market as the proposed high-speed train (generally from Sacramento and the San Francisco Bay Area, through the Central Valley, to Los Angeles and San Diego). The No-Project Alternative satisfies the statutory requirements under CEQA and NEPA for an alternative that does not include any new action or project beyond what is already committed.

The No-Project Alternative defines the existing and future statewide intercity transportation system based on programmed and funded (already in funded programs/financially constrained plans) improvements to the intercity transportation system through 2020, according to the following sources of information:

- State Transportation Improvement Program (STIP)
- Regional Transportation Plans (RTPs) for all modes of travel
- Airport plans
- Intercity passenger rail plans (California Rail Plan 2001-2010, Amtrak Five- and Twenty-year Plans)

As with all of the alternatives, the No-Project Alternative will be assessed against the purpose and need topics/objectives for congestion, safety, air pollution, reliability, and travel times, although the projects in the alternative are primarily local in nature. Within the 270-mile length of the Sacramento to Bakersfield Region, however, a precise quantification of these local impacts is not feasible at this programmatic level of analysis and would not be meaningful as a point of comparison to the overall evaluation of the Modal and HST Alternatives.

Figure 1
No-Project Alternative – California Transportation System

1.1.2 Modal Alternative

There are currently only three main options for intercity travel between the major urban areas of San Diego, Los Angeles, the Central Valley, San Jose, Oakland/San Francisco, and Sacramento: vehicles on the interstate highway system and state highways, commercial airlines serving airports between San Diego and Sacramento and the Bay Area, and conventional passenger trains (Amtrak) on freight and/or commuter rail tracks. The Modal/System Alternative consists of expansion of highways, airports, and intercity and commuter rail systems serving the markets identified for the High-Speed Train Alternative (Figures 2 and 3). The Modal Alternative uses the same inter-city travel demand (not capacity) assumed under the high-end sensitivity analysis completed for the high-speed train ridership in 2020. This same travel demand is assigned to the highways and airports and passenger rail described under the No-Project Alternative, and the additional improvements or expansion of facilities is assumed to meet the demand, regardless of funding potential and without high-speed train service as part of the system.

1.1.3 High-Speed Train Alternative

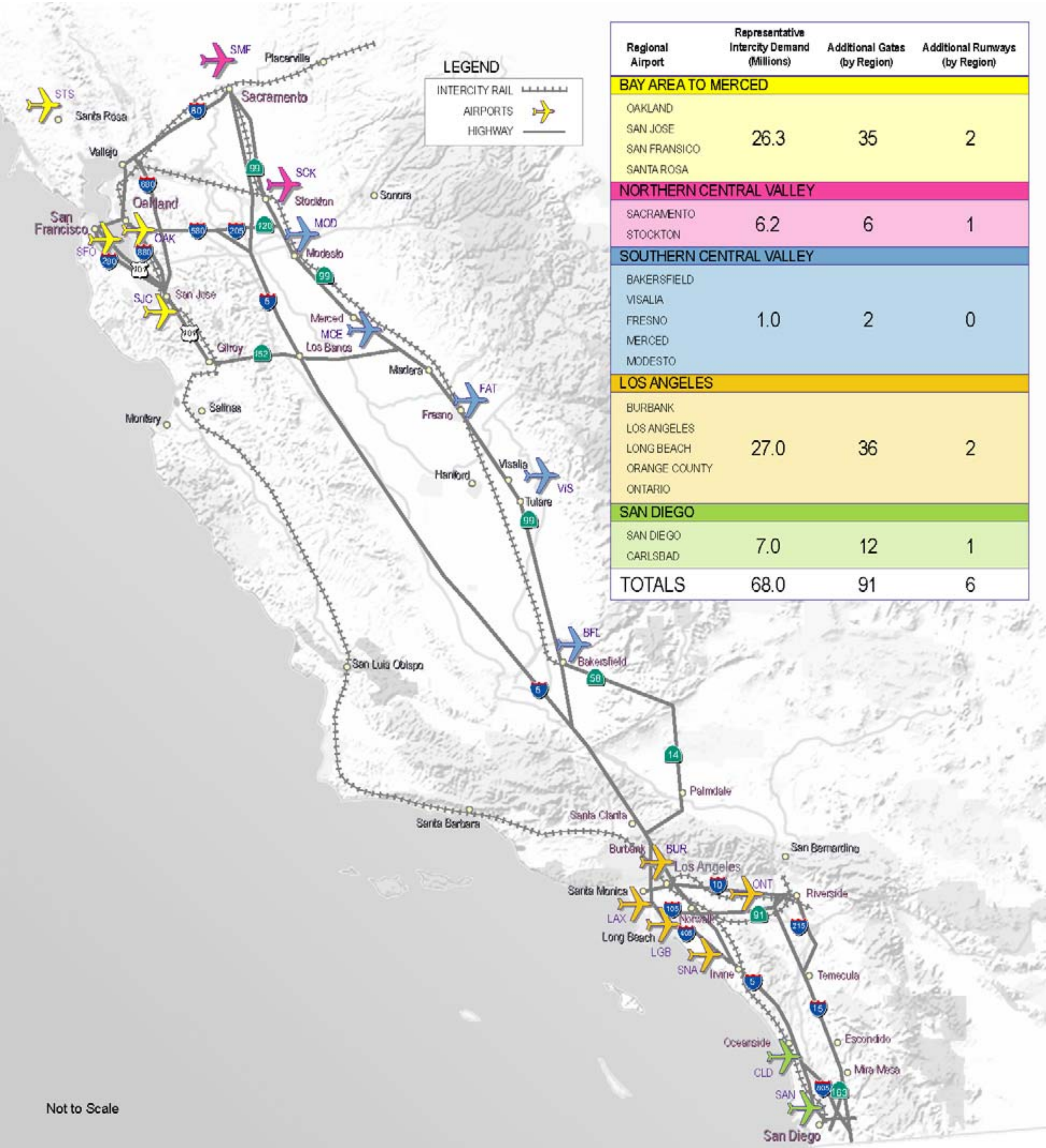
The Authority has defined a statewide high-speed train system capable of speeds in excess of 200 miles per hour (mph) (320 kilometers per hour [km/h]) on dedicated, fully grade-separated tracks, with state-of-the-art safety, signaling, and automated train control systems. State of the art high-speed steel-wheel-on-steel-rail technology is being considered for the system that would serve the major metropolitan centers of California, extending from Sacramento and the San Francisco Bay Area, through the Central Valley, to Los Angeles and San Diego (Figure 4).

The High-Speed Train Alternative includes several corridor and station options. A steel-wheel on steel-rail, electrified train, primarily on exclusive right-of-way with small portions of the route on shared track with other rail is planned. Conventional “non-electric” improvements are also being considered along the existing LOSSAN rail corridor from Los Angeles to San Diego. The train track would be either at-grade, in an open trench or tunnel, or on an elevated guideway, depending on terrain and physical constraints.

For purposes of comparative analysis, the HST corridors are described from station-to-station within each region, except where a by-pass option is considered when the point of departure from the corridor defines the end of the corridor segment. The Sacramento to Bakersfield region has been divided into six corridors: Corridor A runs generally from Sacramento to Stockton; Corridor B, from Stockton to Modesto; Corridor C, from Modesto to Merced; Corridor D, from Merced to Fresno; Corridor E, from Fresno to Tulare; and Corridor F, from Tulare to Bakersfield. Within any given corridor, various alignment options have been developed. Each alignment option is named with an alpha-numeric designation: The letter corresponds to the corridor, and the number refers to a specific route within that corridor. The corridors and alignment routes for HST for this region are defined and presented in Appendix A.

Figure 2
Modal Alternative-Highway Component

Figure 3
Modal Alternative-Aviation Component



Regional Airport	Representative Intercity Demand (Millions)	Additional Gates (by Region)	Additional Runways (by Region)
BAY AREA TO MERCED			
OAKLAND SAN JOSE SAN FRANSICO SANTA ROSA	26.3	35	2
NORTHERN CENTRAL VALLEY			
SACRAMENTO STOCKTON	6.2	6	1
SOUTHERN CENTRAL VALLEY			
BAKERSFIELD VISALIA FRESNO MERCED MODESTO	1.0	2	0
LOS ANGELES			
BURBANK LOS ANGELES LONG BEACH ORANGE COUNTY ONTARIO	27.0	36	2
SAN DIEGO			
SAN DIEGO CARLSBAD	7.0	12	1
TOTALS	68.0	91	6

Figure 4
HST Alternative – Corridors and Stations for Continued Investigation

2.0 BASELINE/AFFECTED ENVIRONMENT

2.1 STUDY AREA

The Study Area for hydrology and water quality is defined as: (1) a 100-foot buffer from the centerline of the High-Speed Train Alternative's proposed alignments and the direct footprint of new station facilities, including a 100-foot buffer from new station facilities; and (2) a 100-foot buffer from the Modal Alternative's direct corridor footprint and/or direct footprint of facilities, including corridors and facilities that would undergo upgrades/expansions.

2.2 REGULATORY ENVIRONMENT

2.2.1 Federal Regulations

Clean Water Act of 1977 and 1987

The purpose of the Clean Water Act (CWA) is to restore and maintain the chemical, physical, and biological integrity of the nation's waters through prevention, and elimination of pollution. It is applicable to any discharge of a pollutant into waters of the United States. Key sections of the CWA include:

1. Section 404 permit for dredge or fill materials from U.S. Army Corps of Engineers.
2. Section 402 permits (National Pollutant Discharge Elimination System [NPDES] permit) for all other discharges are obtained from U.S. Environmental Protection Agency (EPA) or appropriate state agency, which in most cases in the appropriate Regional Water Quality Control Board (RWQCB).
3. Section 401 water quality certification is required from the appropriate RWQCBs.
4. All projects must be consistent with the state Non-point Source Pollution Management Program (Section 319).

<u>Section 401 (33 U.S.C. 1341 and 40 CFR 121)</u>: Section 401 of the CWA requires a water quality certification from the State Water Resources Control Board (SWRCB) or RWQCBs when a project:

1. Requires a federal license or permit (a Section 404 permit is the most common federal permit for highway or rail projects), and
2. Will result in a discharge to waters of the United States. Such certification may be conditioned. Project activities that typically result in a discharge subject to Section 401 water quality certification are the construction and subsequent operation of a facility.

The SWRCB revised the state regulations for the 401 Water Quality Certification Program. These revisions went into effect on June 24, 2000. The likelihood of a passive waiver has been reduced by the revised regulations that certification must be issued or denied before any federal deadline.

<u>Section 402 (33 U.S.C. 1342 and 40 CFR 122)</u>: This section of the CWA establishes a permitting system for the discharge of any pollutant (except dredge or fill material) into waters of the United States. A National Pollutant Discharge Elimination System (NPDES) permit is required for all point discharges of pollutants to surface waters. A point source is a discernible, confined, and discrete conveyance, such as by pipe, ditch, or channel.

<u>Section 404 (33 U.S.C. 1344, 33 CFR Part 323, and 40 CFR Part 230)</u>: Section 404 of the CWA establishes a permit program administered by the U.S. Army Corps of Engineers (ACOE), which regulates the discharge of, dredged or fill material into waters of the United States (including wetlands). The Section 404(b)(1) guidelines allow the discharge of dredged or fill material into the aquatic system only if there is no practicable alternative that would have less adverse impacts.

Wild and Scenic Rivers Act of 1968, as Amended (16 U.S.C. 1271-1287; 36 CFR251, 297; 43 CFR 8350)

The purpose of the Wild and Scenic Rivers Act is to preserve and protect wild and scenic rivers and immediate environments for benefit of present and future generations. It is applicable to all projects which affect designated wild, scenic, and recreational rivers and immediate environment and rivers under study for inclusion into the system. The Act prohibits federal agencies from undertaking activities that would adversely affect the values for which the river was designated. The Act is administered by a variety of state and federal agencies. Designated river segments flowing through federally managed lands are administered by the land-managing agency (e.g., U.S. Forest Service, Bureau of Land Management and the National Park Service). River segments flowing through private lands are administered by the state in conjunction with local government agencies. On projects that affect designated rivers or their immediate environments, consultation will occur through the NEPA process between the state lead agency and the land-managing agencies.

Safe Drinking Water Act of 1944, as Amended (42 U.S.C. 300[f])

The purpose of the Safe Drinking Water Act is to ensure public health and welfare through safe drinking water. The Act is applicable to all public drinking water systems and reservoirs (including rest area facilities). It is also applicable to actions that may have a significant impact on an aquifer or wellhead protection area that is the sole or principal drinking water. This act requires coordination with EPA when an area designated as a principal or sole source aquifer may be impacted by a proposed project. In California, the EPA has designated the following as sole source aquifers: Campo-Cottonwood, Fresno, Ocotillo-Coyote Wells, Santa Margarita, and Scotts Valley.

Executive Order 11988 – Floodplain Management (U.S. DOT Order 5650.2; 23 CFR 650, Subpart A)

Executive Order 11988 directs all federal agencies to avoid all short-term and long-term adverse impacts associated with floodplain modification and to avoid direct and indirect support of development within 100-year floodplains whenever there is a reasonable alternative available.

Projects that encroach upon 100-year floodplains must be supported with additional specific information. The U.S. Department of Transportation Order 5650.2, titled “Floodplain Management and Protection,” prescribes “policies and procedures for ensuring that proper consideration is given to the avoidance and mitigation of adverse floodplain impacts in agency actions, planning programs and budget requests.” The order does not apply to areas with Zone C (areas of minimal flooding as shown on Federal Emergency Management Agency [FEMA] Flood Insurance Rate Maps [FIRM]). The order requires that attention be given and findings made in environmental review documents indicating any risks, impacts, and support from the proposed transportation facility.

Flood Disaster Protection Act (42 U.S.C. 4001-4128; DOT Order 5650.2, 23 CFR 650 Subpart A; and 23 CFR 771)

The purpose of the Flood Disaster Protection Act is to identify flood-prone areas and provide insurance. The Act requires purchase of insurance for buildings in special flood-hazard areas. The Act is applicable to any federally assisted acquisition or construction project in an area identified as having special flood hazards. Projects should avoid construction in, or develop a design to be consistent with, FEMA-identified flood-hazard areas.

2.2.2 State Regulations

California Department of Fish and Game
(Sections 1601-1603 [Streambed Alteration])

Under Sections 1601-1603 of the Fish and Game Code, agencies are required to notify the California Department of Fish and Game (CDFG) prior to any project which would divert, obstruct or change the natural flow or bed, channel or bank of any river, stream or lake. Preliminary notification and project review generally occurs during the environmental process. When an existing fish or wildlife resource may be substantially adversely affected, the CDFG is required to propose reasonable project changes to protect the resource. These modifications are formalized in a "streambed alteration agreement" which becomes part of the plans, specifications and bid documents for a project.

Porter-Cologne Water Quality Act
(Water Code sections 13000 et seq.)

The Porter-Cologne Act is the basic water quality control law for California. The act is implemented by the SWRCB and the nine RWQCBs. The boards implement the permit provisions (Section 402), certain planning provisions (sections 205, 208, and 303 of the federal CWA). This means that the state issues one discharge permit for purposes of both state and federal law. Under state law, the permit is officially called waste discharge requirement. Under federal law, the permit is officially called a NPDES permit. The Porter-Cologne Act requires that anyone who is discharging waste or proposing to discharge waste that could affect the quality of the state's water must file a "report of waste discharge" with that RWQCB.

2.2.3 Other Regulations

As of March 15, 2003, all construction projects within cities and counties in California which would disturb more than one acre of ground must file a notice of intent with the appropriate Regional Water Quality Control Board. For the Sacramento to Bakersfield region, the Central Valley Regional Water Quality Control Board (Region 5) is the appropriate Board. Storm Water Pollution Prevention Plans (SWPPPs) must be prepared prior to filing both the Construction and General Industrial Stormwater (National Pollutant Discharge Elimination System (NPDES) permits. The State Water Resources Control Board (SWRCB) Water Quality Order No. 99-08-DWQ (et seq) applies to construction activity NPDES stormwater permits. SWRCB Order 97-03-DWQ authorizes general industrial stormwater permits.

2.3 BASELINE / AFFECTED ENVIRONMENT

2.3.1 Floodplains

As delineated by the U.S. Federal Emergency Management Agency (FEMA), 100-year floodplains exist along most of the minor creeks and streams in the rural areas of the region. In urban areas and along most of the reaches of the major rivers, the 100-year floodplains are contained within the riverbanks. Levees and floodwalls have been constructed in urban areas, restricting the rivers' flows, many of which also are controlled by upstream dams. Throughout the rural portion of the region, the land is low-lying and subject to frequent shallow flooding.

2.3.2 Surface Waters

There are over two dozen major rivers that could be crossed by the project alternatives. From north to south, those along the possible High-Speed Train Alternative alignments include the Cosumnes River; the Folsom South Canal; Dry Creek; the Mokelumne, Calaveras, Stanislaus, Tuolumne, Merced, Chowchilla, Fresno, San Joaquin, Kings, Kaweah, and Tule Rivers; the Friant-Kern Canal; and the Kern River. Additionally, components of the Modal Alternative on the west side of the Central Valley could cross the California Aqueduct, the San Luis Canal, and the Sacramento-San Joaquin Delta. Groundwater and surface water are pumped to and from these and numerous other surface canals and drains that deliver irrigation water to and from agricultural fields throughout the region. The canals are packed earth or concrete-lined and generally lack the meanders, vegetation, biota, and other features of natural streams. There are no significant lakes or reservoirs within the 100-foot buffer, although small farm ponds are relatively common. They carry water of excellent quality from their sources in the Sierra Nevada, but as they flow through the valley, their quality becomes impaired by each successive use. Both agricultural and potable use and return contribute to this degradation. As flows decrease seasonally, concentrations of total dissolved solids, silt, algae, and pollutants increase: the rivers become turbid, slow-moving, warm, or ephemeral, and contain high amounts of algae and silt.

Surface water quality is influenced by the three separate sources of water that contribute to the flow within local drainage channels: natural streamflow, stormwater and irrigation runoff, and direct discharges. Natural streamflow is limited and depends on the slow drainage of ground water through surface seeps and springs. This water is generally free of contamination, although it often contains high concentrations of dissolved minerals and other naturally occurring solids. Stormwater and irrigation runoff enter streams directly as overland flow, carrying the dissolved or suspended residue of both natural and human land uses within each watershed. The constituents of this runoff can include silt and sand, organic fertilizers and pesticides, heavy metals, oil and grease, animal waste, decaying forest litter, and debris. Direct discharges into streams generally are made only by industrial plants and wastewater treatment facilities. Discharges are regulated locally by the Central Valley Regional Water Quality Control Board (RWQCB), which grants permits for waste discharges and enforces the treatment provisions set forth in each permit.

2.3.3 Erosion

Erosion is a major contributing factor to the degradation for the quality of surface waters in the Central Valley. The silt and sand carried by stormwater runoff are the products of continuing soil erosion within the Sierra Nevada watersheds. As the topography flattens across the project alignments, soil is deposited and accumulates slowly in the channels. The accumulated material gradually lowers the channel capacity and forces flood waters increasingly farther into the surrounding floodplain. Additionally, urbanization and suburbanization result in increased stormwater runoff, causing longer duration, high velocity flows in easily eroded natural stream channels. Upland erosion also causes sedimentation in the floodplains adjacent to the smaller streams and creeks, slowly lowering their capacity to mitigate downstream flooding.

Beginning March 15, 2003, the cities and counties through which the alignments would pass will require that grading projects with an area larger than one acre to prepare and comply with an Erosion and Sediment Control Plan that meets local, regional, and state standards. City, county and state agencies coordinate efforts to implement the NPDES stormwater construction permit program. The applicant must prepare SWPPP for avoiding excessive erosion, capturing sediments before they migrate off-site, and protecting water quality downstream of the project. The SWPPP specifies Best Management Practices (BMPs) such as silt fences, detention basins, rock structures, revegetation, and erosion barriers to minimize the potential for off-site migration of sediments. The SWPPP also contains a section that describes equipment fueling and lubrication practices and defines parking areas and waste storage areas to control any spills from fuel, lubricants, or solvents. The SWPPP is required by the RWQCB, implementing regulations of the Clean Water Act. The county programs are designed to be consistent with permit requirements administered by the RWQCB.

Preparation and implementation of the SWPPP, and compliance with conditions required by the cities, counties and the RWQCB, are required to ensure that erosion and sediment from the construction sites would be controlled such that off-site impacts would be insignificant.

2.3.4 Groundwater

Most of the Valley floor is underlain by several thousand feet of Tertiary or older sediments, which were deposited on a basement complex of granitic and metamorphic rocks. Groundwater in the region is present in unconfined or semi-confined conditions as a part of the Sacramento Valley and San Joaquin Valley groundwater basins. Water is stored in relatively coarse-grained geologic units, such as the Mehrten Formation, the sand and gravel zones of which are used extensively throughout Sacramento County.

Few portions of the Valley have high infiltration capacity. Those that do exist include recharge areas generally existing along active large stream channels that contain substantial amounts of sands and gravels in their stream corridors. Most areas have, at best, moderate recharge capability because of limitations to infiltration created by clay or hardpan layers in the surface soils or subsurface materials.

Groundwater levels fluctuate with seasonal rainfall, withdrawal, and recharge. The large demand for groundwater has caused subsidence in some areas of the Valley. Depth to groundwater in the Valley ranges from a few inches to more that 100 feet.

Groundwater quality throughout the Valley generally is good (with notable exceptions) and within federal and state limits for drinking water. Waters tend to be of sodium bicarbonate type with low total dissolved solids, hardness, iron, and manganese. Septic disposal systems and leach fields are potential sources of nitrate contamination in groundwater, and such uses generally must be approved at a local level, based on local soil conditions and the potential for contamination. Beneficial uses of groundwater underlying the project alignments include are municipal, industrial, and agricultural supply.

3.0 METHODOLOGY FOR IMPACT EVALUATION

The methodology employed for impact evaluation consists of a combination of both qualitative and quantitative assessment. A qualitative assessment was used for general comparisons of the three alternatives, on a segment-by-segment basis, when discussing issues such as runoff rates, sedimentation or other items that require a more detailed approach than what is warranted for this document. Based on each alternative, general conclusions are generated to support the relative change in impact between the alternatives. The No-Project Alternative is the primary basis of comparison. The impacts as a result of the Modal and High-speed Train Alternatives would be characterized as High, Medium or Low as compared to the No-Project Alternative.

A high impact to hydrology and/or water quality would generally be defined as the following:

- Proposed project will result in a substantial encroachment on a floodplain as defined in Executive Order 11998 for Floodplain Management (40 CFR 6.302[a]), or is located in a 100-year floodplain without adequate mitigation measures.
- Proposed project will result in violations of federal, state, or local water quality standards, or will contribute to violation when evaluated cumulatively with other projects in the region.
- Provisions to prevent contamination of surface waters and/or aquifers are not adopted as a part of the proposed project.
- Proposed project will result in substantial alteration in hydrology, including increased stormwater runoff, or increased groundwater discharge or reduction of groundwater recharge.

For medium or low impacts, the results are proportionately less for the hydrology and water quality information presented above. Additional potential impacts to hydrology and water quality include increased/decreased runoff and stormwater discharge from alteration in the amount of paved surfaces, increased or decreased contribution of automotive-based non-point source contamination, impacts on areas of groundwater discharge or infiltration.

For the quantitative assessment, readily available information such as wetland areas, stream locations, impacts on areas with existing water quality problems, flood zones, and soil information is used to assess the magnitude of the impact. For the purposes of this analysis, the study area is defined to include the following: (1) for the High-speed Train Alternative, direct corridors proposed for alternative alignments, including up to a 100-foot buffer from the corridors, the direct footprint of new station facilities, including a 100-foot buffer from new station facilities; and (2) for the Modal Alternative, direct corridors for facilities which would undergo upgrades, including up to a 100-foot buffer from the upgraded facilities.

To evaluate the quantitative impacts to water quality from the proposed High-Speed Train and Modal alternatives, the following was conducted:

- The acreage of floodplains defined as Special Flood Hazard Areas (SFHAs) (as defined by the FEMA on FIRMs) within the study area was determined. In addition, the analysis considers the length of the path in contact with 100-year floodplain (measured in meters) as an indicator of the potential to intersect a sensitive resource.
- The acreage of surface waters (lakes) or linear meters (rivers or streams) within the study area was determined. Surface waters are defined as lakes, rivers, and streams as identified on U.S. Geological Survey (USGS) 1:24,000 scale digital line graphs (DLGs). The linear meters of surface water was calculated based on the flow-path length of rivers and streams within the study area. Lake surface areas represent the impoundment at maximum capacity.

- The location of impaired waters defined as waters identified on the CWA 303(d) list (as distributed by the SWRCB) within the study area was determined.
- The location of potential erosive conditions was identified as those areas with a combination of erosive soils and high slopes, evaluated as the product of "kfact" and "slopeh" (listed in the STATSGO database). Those conditions where "kfact" x "slopeh" is greater than 3.0 are potentially susceptible to erosion, and acreage of these areas within the study area was determined. Because there are no high slopes anticipated within the generally flat topography of the Central Valley, the potential for erosive conditions is not considered significant for this region.

To provide a three level representation (High, Medium, Low) of the impacts to water quality from the proposed alternatives, the following criteria were applied:

- The acreage of **floodplains** within the study area defined as Special Flood Hazard Areas (SFHAs) was considered an indicator of the potential to intersect a sensitive resource.
    - o High sensitivity = 475 to 675 acres
    - o Medium sensitivity = 250 to 475 acres
    - o Low sensitivity = 1 to 250 acres
- The length of the alignment path that would be in contact with **100-year floodplains** (measured in meters) was considered an indicator of the potential to intersect a sensitive resource.
    - o High sensitivity = 25,000 to 38,000 meters
    - o Medium sensitivity = 7,500 to 25,000 meters
    - o Low sensitivity = 1 to 7,500 meters
- The acreage of **lakes** (Figure 5) within the study area identified on United States Geological Survey (USGS) 1:24,000 scale digital line graphs (DLGs) was considered an indicator of the potential to intersect a sensitive resource.
    - o High sensitivity = 0.85 to 1.00 acre
    - o Medium sensitivity = 0.45 to 0.85 acre
    - o Low sensitivity = 0.10 to 0.45 acre
- The length of the alignment path that would be in contact with **lakes** (measured in meters) was considered an indicator of the potential to intersect a sensitive resource.
    - o High sensitivity = 38 to 64 meters
    - o Medium sensitivity = 10 to 38 meters
    - o Low sensitivity = 1 to 10 meters
- The number of **river and stream crossings** (Figure 5) that would occur along the alignment path was considered an indicator of the potential to intersect a sensitive resource.
    - o High sensitivity = 17 to 21 occurrences
    - o Medium sensitivity = 9 to 17 occurrences
    - o Low sensitivity = 1 to 9 occurrences
- The length of **rivers and streams** within the study area (measured in meters) as identified on USGS 1:24,000 scale DLGs was considered an indicator of the potential to intersect a sensitive resource.
    - o High sensitivity = 13,000 to 21,000 meters

- Medium sensitivity = 3,000 to 13,000
- Low sensitivity = 1 to 3,000 meters

- The location of **impaired waters** as identified on the CWA 303(d) list (as distributed by the SWRCB) within the study area was considered an indicator of the potential to intersect a sensitive resource.
  - High sensitivity = 600 to 1,040 meters
  - Medium sensitivity = 250 to 600
  - Low sensitivity = 1 to 250 meters
- The acreage of **groundwater basins** within the study area was not considered an indicator of the potential to intersect a sensitive resource along the High Speed Train alignments because railroad beds are constructed to transmit water, rather than retard it, and because the segments in the Sacramento to Bakersfield region would be at or above grade: there would be no below-grade construction to intersect the water table. Because groundwater basins also occur below the station study areas, where impervious surfaces could be added, the number of acres potentially affected was considered an indicator of the potential to intersect a sensitive resource.
  - High sensitivity = 1,750 to 3,000 acres
  - Medium sensitivity = 750 to 1,750 acres
  - Low sensitivity = 1 to 750 acres

4.0 HYDROLOGY AND WATER QUALITY IMPACTS

4.1 NO-PROJECT ALTERNATIVE

The No-Project Alternative involves only those transportation improvements that have been programmed and funded. They include localized changes to the transportation system – a new or improved interchange, installation of carpool or high occupancy lanes, selective highway widenings, expansions of airport passenger terminals and parking, and track and station upgrades on the conventional passenger rail system. Given the nature of these improvements, the impacts to Hydrologic resources would be limited geographically and areally. Compared to the more extensive Modal and HST Alternatives, the No-Project Alternative would trigger less environmental impact. Nonetheless, this statement is not intended to suggest that the No-Project would *not* have adverse effects. In fact, it is anticipated that collectively the various improvements programmed and funded in the State Transportation Improvement Program, Regional Transportation Plans, Airport Master Plans, and intercity passenger rail plans would have impacts, many of which would require mitigation measures to reduce the effects.

Impacts of the No-Project Alternative would be expected both during the construction period and during the long-term operational period. The effects would occur throughout the Sacramento to Bakersfield region, primarily along the highways where the majority of the funded and programmed improvements are proposed, and at two of the region's airports, Sacramento Metropolitan and Fresno Yosemite International. With respect to the roadway improvements, hydrology and water quality impacts would be greatest in those segments proposed for widening:

- SR 99 from I-5 to Elkhorn Boulevard in Sacramento (Sacramento County)
- I-5 from I-80 to North Market Boulevard (for auxiliary lanes in Sacramento County)
- I-5 from Del Paso Road to SR 99 (for auxiliary lanes in Sacramento County)
- I-5 from Monte Diablo to Country Club (for auxiliary lane in Stockton, San Joaquin County)
- I-5 from Monte Diablo undercrossing to Hammer Lane (Stockton, San Joaquin County)
- I-5 from I-205 to SR 120 northbound (San Joaquin County)
- I-5 from Hammer Lane to Eight Mile Road (Stockton, San Joaquin County)
- SR 99 from Hammer Lane to north of Crosstown Freeway (Stockton, San Joaquin County)
- I-580 from Patterson Pass to Alameda/San Joaquin county line (San Joaquin County)
- SR 99 from south of Jensen Avenue to Ventura Street (for auxiliary lane in Fresno County)
- SR 99 from south of South Pacific and Biola Junction Bridge to Fresno/Madera county line (Fresno County)
- SR 99 from Goshen to SR 201 (Fresno/Tulare County)
- SR 99 from SR 201 to Floral (Fresno County).

Impacts to hydrologic resources that would be expected include:

- loss of groundwater recharge caused by increased area of impervious surfaces and diversion of ephemeral drainage-ways;

- encroachment into the 100-year floodplain and potential loss of floodplain capacity and values;
- substantial alteration of existing stream banks or drainage patterns, resulting in erosion, siltation, or flooding;
- construction runoff, potentially affecting downstream water quality (debris, turbidity, chemicals); and
- increased stormwater runoff, potentially affecting downstream water quality (debris, turbidity, chemicals).

The above impacts are expected to occur whether or not the project build alternatives are constructed and implemented. Each of the proposed intercity travel demand improvements of the No-Project Alternative has been or will be subject to its own environmental clearance process and potential mitigation measures will be identified as part of those individual CEQA and/or NEPA reviews to address substantial impacts.

4.2 MODAL ALTERNATIVE

The Modal Alternative involves a wide range of highway improvements throughout the Sacramento to Bakersfield region and expansions at the Sacramento Metropolitan Airport and the Fresno Airport. The proposed changes to the transportation facilities would primarily occur at grade, with a low probability of interrupting the current hydrologic regime of the region.

Impacts identified for highway and airport expansions are discussed below and reported in Tables 2 and 3.

4.2.1 Floodplains

In the Sacramento to Stockton corridor, there is a *high* potential for floodplain impacts, as 899 acres of the alignment (86,144 linear meters) occur within FEMA-designated floodplains. This corridor has the highest potential for floodplain impacts, in part due to the fact that it possesses the greatest occurrences of stream crossings, passing through the Sacramento-San Joaquin Delta.

Both the Merced to Fresno and the Tulare to Bakersfield corridors pose relatively high potential floodplain impacts with 585 acres (37,390 linear meters) and 454 acres (29,425 linear meters) of the transportation improvements encroaching into the flood hazard zones, respectively.

The Modesto to Merced corridor possesses a medium potential for floodplain impacts with 153 acres (9,905 linear meters) of FEMA-designated floodplains within the buffer area along the highways targeted for widening by this alternative.

In contrast to the Sacramento to Stockton Corridor, the Stockton to Modesto corridor possesses the lowest potential for floodplain impacts, as it contains only 58 acres (3,527 linear meters) of FEMA floodplains. Similarly, the Fresno to Tulare Corridor is rated as having a low potential for flood hazards, because it contains 86 acres (5,517 linear meters) of floodplains within the buffer area along the highways.

4.2.2 Surface Waters, Runoff, and Erosion

The Modal Alternative passes along or across several bodies of water and has the potential to reduce the quality of their waters through the construction of additional traffic lanes and the addition of more vehicles on the roadway. The potential for impact to surface waters is expressed as “meters of linear contact” for streams and “area of contact” for lakes. The actual resource that may be affected depends as much on final project design with incorporated mitigation measures, as the amount of contact. Streams that have 303(d) protection are considered as having the greatest sensitivity to disturbance by construction or operational activities.

Table 1
Sacramento to Bakersfield Region
Hydrology and Water Quality Floodplains and Stream Crossing Impacts

	Floodplains		Stream Crossings (Meters)			Stream Crossings (occurrences)		
	Floodplain Acres	Floodplain Meters	Improved	Irrelevant	Natural	Improved	Irrelevant	Natural
No-Build	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Modal								
Sacramento to Stockton	899	86,144	8,659	-	4,690	82	-	66
Stockton to Modesto	58	3,527	1,594	-	3,055	21	-	25
Modesto to Merced	153	9,905	1,252	-	1,697	16	-	25
Merced to Fresno	585	37,390	7,220	-	6,884	54	-	80
Fresno to Tulare	86	5,517	2,101	-	2,385	28	-	35
Tulare to Bakersfield	454	29,425	4,179	-	5,513	59	-	64
HST Corridor & Station Options								
Sacramento to Stockton								
Alignments								
A1	371	17,750	11,782	254	5,853	5	1	10
A2	459	19,740	10,509	0	5,426	5	0	11
A3	610	19,735	4,648	254	6,219	5	1	10
A4	644	21,725	3,159	0	5,205	4	0	10
A5	276	15,228	11,782	254	4,900	5	1	8
A6	252	15,343	11,782	0	4,263	5	0	8
A7	515	17,213	4,648	254	5,265	5	1	8
A8	491	17,328	4,648	0	4,629	5	0	8
Stations								
Sacramento Downtown Depot	0.7	N/A	0	0	0	0	0	0
Power Inn Road Station (BNSF Option)	16.1	N/A	0	0	0	0	0	0
Power Inn Road Station (UPRR Option)	17.6	N/A	0	0	0	0	0	0
Stockton ACE Downtown Station	0.0	N/A	0	0	0	0	0	0
Maintenance Facilities								
Sacramento Maintenance Facility BNSF Alt	48	N/A	1489	0	331	1	0	2
Sacramento Maintenance Facility UPRR Alt	47	N/A	188	0	0	2	0	0

	Floodplains		Stream Crossings (Meters)			Stream Crossings (occurrences)		
	Floodplain Acres	Floodplain Meters	Improved	Irrelevant	Natural	Improved	Irrelevant	Natural
Stockton to Modesto								
Alignments								
B1	14	2,421	2,986	0	183	3	0	3
B2	84	17,801	3,618	175	210	2	1	2
Stations								
Modesto Downtown Station	0	N/A	0	0	0	0	0	0
Modesto Briggsmore Station	0	N/A	0	0	0	0	0	0
Modesto to Merced								
Alignments								
C1	133	2,292	3,992	122	207	4	1	3
C2	413	14,917	4,374	122	1,066	6	1	6
C3	155	7,590	3,365	122	300	4	1	3
C4	442	25,756	3,747	122	645	6	1	5
C5	256	11,224	3,725	144	844	4	1	4
C6	536	18,822	4,014	144	1,728	5	1	7
C7	257	11,417	3,726	144	526	4	1	4
C8	544	24,556	4,014	144	897	5	1	6
C9	289	12,935	1,041	0	939	3	0	4
C10	296	18,476	1,041	0	426	3	0	3
C11	301	9,382	3,831	144	1,085	3	1	4
C12	309	14,923	3,831	144	572	3	1	3
C13	311	13,000	4,263	144	1,085	4	1	4
C14	266	14,842	4,157	144	844	5	1	4
C15	318	18,541	4,263	144	572	4	1	3
C16	266	15,035	4,158	144	526	5	1	4
Stations								
Merced Downtown Station	18	N/A	0	0	0	0	0	0
Merced Municipal Airport Station	12	N/A	0	0	0	0	0	0
Castle Air Force Base Station	0	N/A	0	0	0	0	0	0
Merced to Fresno								
Alignments								
D1	321	26,785	1,609	131	1,479	5	1	3
D2	326	33,654	3,827	131	1,553	7	1	4
D3	320	26,785	873	131	1,479	5	1	3
D4	325	33,926	2,336	131	1,553	7	1	4
D5	336	26,279	1,113	0	759	4	0	2
D6	343	35,629	2,436	139	840	6	1	3
D7	338	26,279	1,849	0	759	4	0	2
D8	345	35,356	3,927	139	840	6	1	3
Stations								
Fresno Downtown Station	13	N/A	0	0	0	0	0	0

	Floodplains		Stream Crossings (Meters)			Stream Crossings (occurrences)		
	Floodplain Acres	Floodplain Meters	Improved	Irrelevant	Natural	Improved	Irrelevant	Natural
Fresno to Tulare								
Alignments								
E1	200	10,305	3,933	0	840	2	0	2
E2	5	1,681	787	0	857	3	0	3
Stations								
Visalia Airport Station	0	N/A	381	0	0	1	0	0
Hanford Station	0	N/A	0	0	0	0	0	0
Tulare to Bakersfield								
Alignments								
F1	231	23,736	6,443	191	659	8	2	4
F2	243	23,033	6,366	191	659	7	2	4
F3	239	23,267	5,507	233	659	8	2	4
F4	235	23,502	5,430	233	659	7	2	4
F5	231	23,736	11,391	111	883	7	1	2
F6	227	23,971	11,314	111	883	6	1	2
F7	223	24,205	6,443	191	659	8	2	4
F8	219	24,440	6,366	191	659	7	2	4
F9	215	24,674	5,507	233	659	8	2	4
F10	211	24,909	5,430	233	659	7	2	4
F11	207	25,144	11,391	111	883	7	1	2
F12	203	25,378	11,314	111	883	6	1	2
F13	200	25,613	6,495	191	659	7	2	4
F14	196	25,847	5,559	233	659	7	2	4
F15	192	26,082	7,067	281	900	8	2	5
F16	188	26,316	6,991	281	900	7	2	5
F17	184	26,551	6,131	323	899	8	2	5
F18	180	26,785	6,054	323	899	7	2	5
F19	176	27,020	7,179	191	968	11	2	6
F20	172	27,254	7,103	191	968	10	2	6
F21	168	27,489	6,243	233	967	11	2	6
F22	164	27,724	6,166	233	967	10	2	6
F23	160	27,958	10,526	201	1,125	6	1	3
F24	156	28,193	10,450	201	1,125	5	1	3
Stations								
Bakersfield Airport Station	0	N/A	0	0	0	0	0	0
Golden State Station	0	N/A	0	0	0	0	0	0
Truxton (Union Avenue) Station	0	N/A	0	0	0	0	0	0
Truxtun (Amtrak) Station	0	N/A	273	0	0	1	0	0
Maintenance Facilities								
Main Maintenance Facility BNSF Alt	0	N/A	0	0	0	0	0	0
Main Maintenance Facility UPRR Alt	0	N/A	0	0	0	0	0	0

Table 2
Sacramento to Bakersfield Region,
Hydrology and Water Quality Lakes and Groundwater Impacts

	Lakes			Groundwater Basins (acres)						
	Occur-rences	Length (Meters)	Acres	Sacra-mento Valley	San Joaquin Valley	Gilroy-Hollister Valley	Livermore Valley	Tehachapi Valley East	Tehachapi Valley West	Santa Clara Valley
No-Build	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Modal										
Sacramento to Stockton	2	477.252	6.95	2151.5	1665.114	0	160.4	0	0	220.165
Stockton to Modesto	0	0	0	0	1280.676	0	0	0	0	0
Modesto to Merced	0	0	0	0	1785.454	0	0	0	0	0
Merced to Fresno	3	649.309	9.811	0	4339.926	586.156	0	0	0	0
Fresno to Tulare	0	0	0	0	1526.446	0	0	0	0	0
Tulare to Bakersfield	0	0	0	0	5458.593	0	0	81.291	118.695	0
HST Corridor & Station Options										
Sacramento to Stockton										
Alignments										
A1	1	62	0.94	577	1,743	0	0	0	0	0
A2	0	0	0.00	657	2,236	0	0	0	0	0
A3	1	62	0.94	577	1,645	0	0	0	0	0
A4	0	0	0.00	657	1,735	0	0	0	0	0
A5	1	62	0.94	342	1,743	0	0	0	0	0
A6	0	0	0.00	302	1,833	0	0	0	0	0
A7	1	62	0.94	342	1,645	0	0	0	0	0
A8	0	0	0.00	302	1,735	0	0	0	0	0
Stations										
Sacramento Downtown Depot	0	0	0	40.791	0	0	0	0	0	0
Power Inn Road Station (BNSF Option)	0	0	0	17.639	0	0	0	0	0	0
Power Inn Road Station (UPRR Option)	0	0	0	17.642	0	0	0	0	0	0
Stockton ACE Downtown Station	0	0	0	0	19.47	0	0	0	0	0
Maintenance Facilities										
Sacramento Maintenance Facility BNSF Alt	0	0	0	58.555	0	0	0	0	0	0
Sacramento Maintenance Facility UPRR Alt	0	0	0	63.238	0	0	0	0	0	0

	Lakes			Groundwater Basins (acres)						
	Occur-rences	Length (Meters)	Acres	Sacra-mento Valley	San Joaquin Valley	Gilroy-Hollister Valley	Livermore Valley	Tehachapi Valley East	Tehachapi Valley West	Santa Clara Valley
Stockton to Modesto										
Alignments										
B1	0	0	0.00	0	822	0	0	0	0	0
B2	0	0	0.00	0	418	0	0	0	0	0
Stations										
Modesto Downtown Station	0	0	0	0	15.947	0	0	0	0	0
Modesto Briggsmore Station	0	0	0	0	21.385	0	0	0	0	0
Modesto to Merced										
Alignments										
C1	0	0	0.00	0	1,676	0	0	0	0	0
C2	0	0	0.00	0	1,985	0	0	0	0	0
C3	0	0	0.00	0	1,418	0	0	0	0	0
C4	0	0	0.00	0	1,734	0	0	0	0	0
C5	1	4	0.39	0	983	0	0	0	0	0
C6	1	4	0.39	0	1,276	0	0	0	0	0
C7	1	4	0.39	0	983	0	0	0	0	0
C8	1	4	0.39	0	1,284	0	0	0	0	0
C9	0	0	0.00	0	906	0	0	0	0	0
C10	0	0	0.00	0	913	0	0	0	0	0
C11	1	4	0.39	0	998	0	0	0	0	0
C12	1	4	0.39	0	1,005	0	0	0	0	0
C13	1	4	0.39	0	1,211	0	0	0	0	0
C14	1	4	0.39	0	1,196	0	0	0	0	0
C15	1	4	0.39	0	1,218	0	0	0	0	0
C16	1	4	0.39	0	1,196	0	0	0	0	0
Stations										
Merced Downtown Station	0	0	0	0	18.303	0	0	0	0	0
Merced Municipal Airport Station	0	0	0	0	11.672	0	0	0	0	0
Castle Air Force Base Station	0	0	0	0	13.035	0	0	0	0	0
Merced to Fresno										
Alignments										
D1	0	0	0.00	0	1,521	0	0	0	0	0
D2	0	0	0.00	0	2,143	0	0	0	0	0
D3	0	0	0.00	0	1,390	0	0	0	0	0
D4	0	0	0.00	0	1,960	0	0	0	0	0
D5	0	0	0.00	0	1,326	0	0	0	0	0
D6	0	0	0.00	0	1,864	0	0	0	0	0
D7	0	0	0.00	0	1,457	0	0	0	0	0
D8	0	0	0.00	0	2,047	0	0	0	0	0
Stations										
Fresno Downtown Station	0	0	0	0	13.006	0	0	0	0	0

	Lakes			Groundwater Basins (acres)						
	Occur-rences	Length (Meters)	Acres	Sacra-mento Valley	San Joaquin Valley	Gilroy-Hollister Valley	Livermore Valley	Tehachapi Valley East	Tehachapi Valley West	Santa Clara Valley
Fresno to Tulare										
Alignments										
E1	0	0	0.00	0	753	0	0	0	0	0
E2	0	0	0.00	0	721	0	0	0	0	0
Stations										
Visalia Airport Station	0	0	0	0	12.484	0	0	0	0	0
Hanford Station	0	0	0	0	10.91	0	0	0	0	0
Tulare to Bakersfield										
Alignments										
F1	0	0	0.00	0	1,950	0	0	0	0	0
F2	0	0	0.00	0	1,747	0	0	0	0	0
F3	0	0	0.00	0	1,958	0	0	0	0	0
F4	0	0	0.00	0	1,755	0	0	0	0	0
F5	0	0	0.00	0	2,157	0	0	0	0	0
F6	0	0	0.00	0	1,954	0	0	0	0	0
F7	0	0	0.00	0	1,950	0	0	0	0	0
F8	0	0	0.00	0	1,747	0	0	0	0	0
F9	0	0	0.00	0	1,958	0	0	0	0	0
F10	0	0	0.00	0	1,755	0	0	0	0	0
F11	0	0	0.00	0	2,157	0	0	0	0	0
F12	0	0	0.00	0	1,954	0	0	0	0	0
F13	0	0	0.00	0	1,779	0	0	0	0	0
F14	0	0	0.00	0	1,787	0	0	0	0	0
F15	0	0	0.38	0	2,375	0	0	0	0	0
F16	0	0	0.38	0	2,172	0	0	0	0	0
F17	0	0	0.38	0	2,382	0	0	0	0	0
F18	0	0	0.38	0	2,179	0	0	0	0	0
F19	0	0	0.00	0	2,175	0	0	0	0	0
F20	0	0	0.00	0	1,972	0	0	0	0	0
F21	0	0	0.00	0	2,183	0	0	0	0	0
F22	0	0	0.00	0	1,980	0	0	0	0	0
F23	0	0	0.38	0	2,168	0	0	0	0	0
F24	0	0	0.38	0	1,965	0	0	0	0	0
Stations										
Bakersfield Airport Station	0	0	0	0	29.223	0	0	0	0	0
Golden State Station	0	0	0	0	18.699	0	0	0	0	0
Truxton (Union Avenue) Station	0	0	0	0	12.345	0	0	0	0	0
Truxtun (Amtrak) Station	0	0	0	0	31.985	0	0	0	0	0
Maintenance Facilities										
Main Maintenance Facility BNSF Alt	0	0	0	0	140.239	0	0	0	0	0
Main Maintenance Facility UPRR Alt	0	0	0	0	140.239	0	0	0	0	0

Impacts to surface waters, runoff, and erosion are presented in Tables 2 and 3. The Sacramento to Stockton and Merced to Fresno Corridors pose the greatest potential impacts to surface waters and runoff as they cross or come in close contact to many lakes and streams. The Sacramento to Stockton Corridor has the potential for impacts to two lakes, 66 natural stream crossings, and 82 improved stream crossings. By contrast, the Stockton to Merced Corridor appears to have the least impacts, as it does not cross or come in contact with any lakes and crosses 25 natural stream crossings.

4.2.3 Groundwater

All of the corridors cross either the Sacramento Valley or the San Joaquin Valley Groundwater Basins. Additionally, the Modal Alternatives includes highway improvements in areas that cross other ground water basins including Gilroy-Hollister, Livermore Valley, Tehachapi Valley, and the Santa Clara Valley. The transportation facilities would be at grade or above grade and thus would not be expected to interfere with subsurface water movement. Moreover, the footprint of the facilities are minimal compared to the size of the groundwater recharge areas and would not be expected to interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume. Even though the types of the improvements vary from highway widening projects to airport expansions, the impacts to groundwater basins is considered to be low.

4.3 HIGH-SPEED TRAIN ALTERNATIVE

Impacts identified for High-Speed Train Alternative are discussed below. The results of the analysis are included in Tables 2 and 3, above.

4.3.1 Floodplains

Alignments

Sacramento to Stockton Corridor: The Sacramento to Stockton corridor has eight optional alignments. Some floodplain interaction would occur for all of the options. Based on a comparison of all alignments for this route, the CCT route (A6) has the lowest potential for floodplain impacts. The highest floodplain interaction occurs with A3 and A8, along the UP right-of-way, and A4 and A7, along the CCT right-of-way. A medium potential for flood hazards would occur for A1 and A5 both of which follow the UP route, and for A2 and A6 along the CCT route. Of the eight options in this corridor, A4 has 644 acres or 2.5 times as many floodplain acres that could be potentially affected compared to the lowest rated alignment (A6 with 252 acres). This rating is corroborated by the length of path in the contact with floodplain acres: 21,725 meters for A4 versus 15,343 meters for A6.

Stockton to Modesto Corridor: This corridor has two alignments, and there is no notable difference between the two in terms of flooding hazards. Both the UP alignment (B1) and the BNSF alignment (B2) are rated low for potential floodplain interaction when compared to alignments elsewhere in the Sacramento to Bakersfield region. Even though B2 has six times the acreage in floodplains as B1 and 7.3 times the contact path as B1, they both have minimal contact surface when compared to other corridors.

Modesto to Merced Corridor: This stretch of the Sacramento to Bakersfield region has sixteen alignment options with all but two rated high or medium in potential floodplain interaction. The lowest rated alignments are along the UP (C1 and C3) with 133 and 155 floodplain acres potentially affected and 2,292 and 7,590 meters of floodplain length, respectively. C6 and C8 along the BNSF route are rated as having a high potential for flood hazards, whereas C2 and C4 through C11 are rated as having a medium potential for impact.

Merced to Fresno Corridor: Eight alignment options are evaluated in this corridor, and all of them are similar in potential flood impact. There is no significant difference among the alignment options as all have 320 to 345 floodplain acres potentially affected. Compared to other corridors and alignment options in the Sacramento to Bakersfield region, this is considered a medium potential. However, all of the routes are rated as high in potential for impact when comparing the length of alignment that crosses floodplain acres. The lengths range from 26,279 meters for D5 and D7 to 35,356 meters for D8.

Fresno to Tulare: The two corridor-alignment options for the Fresno to Tulare Corridor are rated as having a low potential to be exposed to flood hazards, compared to routes elsewhere in the region. Even though both receive a low rating, E1 along the UP route has 10,305 meters that cross a floodplain compared to 1,681 meters for E2 along the BNSF alignment.

Tulare to Bakersfield Corridor: This segment of the HST Alternative has 24 alignment options. All of the options are similar in potential flooding impacts. F24 along the BNSF alignment is considered the lowest in potential and has the fewest acres potentially affected at 156. F2 along the UP is considered to have a medium potential for flood hazards, given it potential acreage of floodplain interaction (243 acres). The other alignment options are proportionally similar in amount of acres affected. There is no appreciable difference in the lengths of the 24 routes crossing a floodplain. Using this measure, all of the options are considered to have a high potential for floodplain effects.

Stations and Maintenance Facilities

Sacramento to Stockton Corridor: Each of the Sacramento station options in the Sacramento to Stockton Corridor occurs within the 100-year FEMA floodplain. The Downtown Station option (S1) has less than an acre of its footprint within this flood hazard zone and, thus, is rated as having a low potential for flood hazard. In contrast, the two station options at Power Inn Road (S2 along the UP and S3 along the BNSF) both encroach into more floodplain area and are considered to have a medium potential for flood impacts.

The Stockton ACE Downtown Station would not be in the 100-year FEMA floodplain

Both maintenance facilities (M1 along the UP and M2 along the BNSF) encroach into comparable amounts of 100-year FEMA floodplain. Compared to the stations and other maintenance facilities in the Sacramento to Bakersfield region, the magnitude of encroachment (slightly less than 50 acres each) would be regarded as a high potential for flood hazard impacts.

Stockton to Modesto Corridor: None of the station options in Modesto would affect 100-year FEMA floodplains. Accordingly, the potential for encountering flood hazards at these stations is low.

Modesto to Merced Corridor: Both stations in the Merced area would occur within the 100-year FEMA floodplain. The footprint of the Merced Downtown Station (S8) would overlap with the flood hazard zone by about 18 acres. The footprint of the Merced Airport Station (S9) encroaches about 12 acres into the floodplain. Compared to other stations in the Sacramento to Bakersfield region, these acreages translate into a medium potential for flood hazard impacts. In contrast, the Castle Air Force Base Station (S7) would not affect any FEMA-designated land and would therefore have a low rating for potential flood effects.

Merced to Fresno Corridor: The Fresno Downtown Station (S10) is located in the 100-year floodplain. With about 13 acres in the FEMA-designated hazard area, there is a medium potential for flood impacts.

Fresno to Tulare Corridor: The Visalia Airport Station (S11) on the UP route would minimally encroach into the 100-year floodplain. With less than 1 acre in the flood hazard area, this station would have a low risk of flood hazard impacts. The Hanford Station along the BNSF route (S12) would not encroach into any FEMA-designated areas and would also be rated as having a low potential flood impact.

Tulare to Bakersfield Corridor: None of the stations or maintenance facility options in the Tulare to Bakersfield Corridor overlaps with a FEMA-designated area. Accordingly, all would be rated as having a low potential for flooding.

4.3.2 Surface Waters, Runoff, and Erosion

Alignments

Sacramento to Stockton Corridor: For the Sacramento to Stockton Corridor, the eight alignment options are rated as having a medium or high potential for surface water impact when considering encroachment on streams and rivers. Compared to the other alignments, a medium potential for impact exists on A4 with 982 meters of 303(d) stream contact and 8,364 meters of total stream contact. The alignments considered to have the highest potential for water quality impacts are those with the longest lengths in contact with streams: A1 and A5 along the UP and A2 and A6 along the CCT. Contact lengths for these alignment options range from 10,509 meters to 11,782 meters. In addition, A1 and A2 are also rated high for contact with streams listed as impaired under the Federal Clean Water Act Section 303(d). The total contact lengths for these 303(d) protected streams are 17,889 meters for A1 and 15,935 meters for A2. A1 is also rated high in area of contact with lakes. For these reasons, A1 and A2 are considered as having the greatest potential to affect surface waters in the Sacramento to Stockton Corridor.

Stockton to Modesto Corridor: There are two optional routes in this corridor. There is no notable difference between the two in terms of effects on surface waters. Both B1 along UP alignment and B2 along the BNSF alignment are rated as having a medium potential to affect surface waters, using the meters of streams contacted criterion. No contact with lakes is expected in this corridor; however, there is the potential for 150 to 180 meters of contact with 303(d) listed streams.

Modesto to Merced Corridor: The Modesto to Merced segment of the Sacramento to Bakersfield region has 16 alignment options with potential surface water effects ratings from low to medium. The routes with the fewest meters along a stream considered natural and thus considered low in potential impact to surface waters are C1 and C3, with 207 and 300 meters, respectively, and 150 meters of 303(d) streams. On the other hand, these routes have a moderate 2,292- and 7,590-meter footprint encroaching onto streams classified as have some existing alteration to their bed or banks. The alignment options following C9 and 10 along the UP right-of-way have the fewest meters along altered streams (1,980 meters and 1,467 meters, respectively), but are moderate in their encroachment into natural streams at 939 and 426 meters, respectively, and 150 meters for 303(d) listed streams. The other alignments are significantly higher in terms of their potential impact, but they are still rated as having a medium potential to affect surface waters, when compared to other routes in the Sacramento to Bakersfield region. These routes all have a total encroachment greater than 4,300 meters and over 300 meters along 303(d) streams.

Merced to Fresno Corridor: In the Merced to Fresno Corridor, the eight alignment options have low to medium impact potential to affect surface waters. None of the watercourses in this corridor are 303(d) streams. The lowest encroachment potential exists for D5 and D7. Both routes are equally low in contact with natural stream at 759 meters. D5 has a total of 1,872 meters of contact with both natural and altered streams and D7 has 2,608 meters. A close second are D6 and D8 along the UP at 840 linear meters of natural streams in contact with the alignment options. Both routes have similar contact with altered streams at 2,436 and 3,927 meters, respectively. The D3 route is low in total contact with streams at 2,482 meters, but this length includes 1,479 meters in contact with natural streams, which suggests a medium potential to affect the surface waters nearby. The route with the highest encroachment potential is D2 along the BNSF route at 1,553 meters of encroachment to natural streams and 3,827 meters in contact with altered streams, for a total of 5,510 meters.

Fresno to Tulare Corridor: The Fresno to Tulare Corridor has two alignment options. E2 along the BNSF right-of-way is rated as having a low potential to disturb natural streams at 857 meters and altered streams at 787 meters, for a total of 1,644 meters. There is also a relatively low 67 acres of encroachment on 303(d) streams. In contrast, E1 following the UP right-of-way has a medium potential to affect surface waters, because 840 meters of natural streams could be disturbed and 3,933 meters are in contact with altered stream systems.

Tulare to Bakersfield: There are 24 alignment options in this corridor. All options are considered as medium in potential impact to natural and altered stream systems. Every alignment option has more than 6,000 meters of encroachment on both natural and altered stream systems, but no effect to 303(d) streams. This level of contact is considered to result in a medium potential for impacts, compared to all corridors in the Sacramento to Bakersfield region. Considering contact with natural streams, the range is a low 659 meters for F1, F2, F3, F4, F7, F8, F9, F10, F13, and F14 (on the UP) to the highest 1,125 meters for F23 and F24 routes (on the BNSF).

Stations and Maintenance Facilities

Of the station and maintenance facility options, only the maintenance facilities in Sacramento, the Visalia Airport Station, and the Truxtun Amtrak Station on the BNSF occur near watercourses. The only natural waterway that could be subject to adverse effects from construction and long-term operation of the HST Alternative is along the Sacramento maintenance facility option on the BNSF (M2). This waterway is also a protected 303d water body, which is why M2 is rated as having a potentially high effect on surface waters.

The other facilities occur near waterways that are improved and the length of contact varies between 200 and 400 meters. For these facilities (i.e., the Sacramento maintenance facility on the UP, the Visalia Airport Station, and the Truxtun Amtrak Station), the potential erosion and runoff impacts from construction and operation of the HST is considered to be medium.

All other stations and maintenance facility options in the Sacramento to Bakersfield region do not lie within the established buffer zone for impacts to waterways or 303d water bodies. Consequently, the potential for runoff, erosion, or other water quality effects from these facilities is considered to be low.

4.3.3 Groundwater

All of the HST alignment options and station/maintenance facility options overlie either the Sacramento Valley or the San Joaquin Valley Groundwater Basins. The facilities would be at grade or above grade and thus would not interfere with subsurface water movement. Moreover, the footprint of the facilities is minimal compared to the size of the groundwater recharge areas and would not be expected to interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume. Thus, the impacts to groundwater basins of the HST Alternative is considered to be low.

5.0 REFERENCES

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Federal Regulations

Clean Water Act of 1977 and 1987

Section 401 (33 U.S.C. 1341 and 40 CFR 121):

Section 402 (33 U.S.C. 1342 and 40 CFR 122):

Section 404 (33 U.S.C. 1344, 33 CFR Part 323, and 40 CFR Part 230):

Wild and Scenic Rivers Act of 1968, as Amended (16 U.S.C. 1271-1287; 36 CFR251, 297; 43 CFR 8350)

Safe Drinking Water Act of 1944, as Amended (42 U.S.C. 300[f])

Executive Order 11988 – Floodplain Management (U.S. DOT Order 5650.2; 23 CFR 650, Subpart A)

Flood Disaster Protection Act (42 U.S.C. 4001-4128; DOT Order 5650.2, 23 CFR 650 Subpart A; and 23 CFR 771)

State Regulations

California Department of Fish and Game (Sections 1601-1603 [Streambed Alteration])

Porter-Cologne Water Quality Act (Water Code sections 13000 et seq.)

State Water Resources Control Board (SWRCB) Water Quality Order No. 99-08-DWQ (et seq)

SWRCB Order 97-03- DWQ (et seq)

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APPENDICES

APPENDIX – A

Corridor and Design Options for High-Speed Train Alternative

CORRIDOR AND DESIGN OPTIONS FOR HIGH-SPEED TRAIN ALTERNATIVE

SACRAMENTO TO BAKERSFIELD

Corridor Definition

The Central Valley region has been divided into six discrete corridors:

Corridor A, Sacramento to Stockton

Corridor B, Stockton to Modesto

Corridor C, Modesto to Merced

Corridor D, Merced to Fresno

Corridor E, Fresno to Tulare

Corridor F, Tulare to Bakersfield

Design Options

There are two or more HST alignment alternatives within each Corridor, distinguished by parallel route (UPRR or BNSF), station site served, route connection (UPRR or BNSF) to the south, and station configuration (off-line "loop" or standard). HST alternatives are shown on the alignment exhibits in this Appendix.

Within the Sacramento to Bakersfield region, the HST project would be built primarily at-grade. With the exception of specific and localized grade separations, which may include structures to carry the HST alignment over existing roadway or railroad facilities, proposed aerial structures within the Central Valley would include those listed below. The specific location, number, and length of structures will be determined during the next phase of design.

Aerial Structure Locations			
HST Alignment Option(s)	**Aerial Structure Location**	**Approximate Limits**	**Length (ft)**
Corridor A			
Sacramento Depot alignments: A1 thru A4	Sacramento	Sacramento Downtown Depot to the Elvas Wye	17,000
Sacramento Depot alignments parallel to UPRR north of Stockton: A1, A3	Sacramento	Folsom Blvd to 14th Avenue	6,000
All alignments: A1 thru A8	Stockton	Harding Way to Mormon Slough	7,000
Corridor B			
Modesto Downtown Station alignment: B1	Modesto	Kansas Avenue to Tuolumne River	9,000
Modesto Briggsmore Station alignment: B2	Escalon	Yosemite Avenue to St. John Road	5,000
Modesto Briggsmore Station alignment: B2	Riverbank	South of Patterson Road to Claribel Road	7,000
Corridor C			
All alignments parallel to UPRR north of Merced: C1, C2, C3, C4, C9, C10	Turlock	Broadway to Berkeley Avenue	12,000

Aerial Structure Locations			
HST Alignment Option(s)	**Aerial Structure Location**	**Approximate Limits**	**Length (ft)**
All alignments parallel to UPRR north of Merced: C1, C2, C3, C4, C9, C10	South of Delhi	High Fine Canal to Merced River	8,000
All alignments parallel to UPRR north of Merced: C1, C2, C3, C4, C9, C10	Atwater	Atwater Canal/Jordan Canal to SR99 Overpass	13,000
Corridor D			
All alignments parallel to UPRR north of Fresno: D5, D6, D7, D8	Madera	Fresno River to Olive Avenue	8,000
All alignments: D1 thru D8	Fresno	Ashlan Avenue to Clinton Avenue	12,000
All alignments: D1 thru D8	Fresno	Belmont Avenue to SR180 Overpass	4,000
Corridor E			
Visalia Airport Station alignment: E1	Selma	Floral Avenue to Nebraska Avenue	8,000
Hanford Station alignment: E2	Hanford	11th Avenue to south of 3rd Street	6,000
Corridor F			
All alignments thru Tulare: F1, F2, F7, F8, F13, F15, F16, F19, F20	Tulare	Prosperity Avenue/Avenue 240 to Bardsley Avenue	11,000
All alignments parallel to UPRR north of Bakersfield: F1 thru F4, F7 thru F10, F13 thru F22	Delano	Cecil Avenue to High Street	8,000
All alignments parallel to BNSF north of Bakersfield: F5, F6, F11, F12, F23, F24	Corcoran	Orange Avenue to Pickerell Avenue	6,000
All alignments parallel to BNSF north of Bakersfield: F5, F6, F11, F12, F23, F24	Shafter	Tulare Avenue to Lerdo Highway	4,000
Truxtun (Amtrak) Station (without loop) alignments parallel to UPRR north of Bakersfield: F15 thru F18	Famoso	North of Poso Creek to south of SR99	16,000
Bakersfield Airport Station, Golden State Station, Truxtun (Union Avenue) Station, and Truxtun (Amtrak) Station (with high-speed loop) alignments: F1 thru F6, F7 thru F12 F13, F14, F19 thru F22	Bakersfield	North of Norris Road to Olive Drive	6,000
Bakersfield Airport Station, Golden State Station, Truxtun (Union Avenue) Station, and Truxtun (Amtrak) Station (with high-speed loop) alignments: F1 thru F6, F7 thru F12 F13, F14, F19 thru F22	Bakersfield	Beale Avenue to Mount Vernon Avenue	7,000
Truxtun (Amtrak) Station alignments: F15 thru F24	Bakersfield	North of Mohawk Street to Carrier Canal	8,000
Truxtun (Amtrak) Station alignments: F15 thru F24	Bakersfield	F Street to Truxtun Avenue	14,000